

Victorian Certificate of Education
Year

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

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APPLIED COMPUTING:
SOFTWARE DEVELOPMENT
Written examination

Day Date

Reading time: *.* to *.* (15 minutes)

Writing time: *.* to *.* (2 hours)

QUESTION AND ANSWER BOOK

Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks
A	20	20	20
B	5	5	20
C	13	13	60
			Total 100

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

Materials supplied

- Question and answer book of 28 pages
- Detachable insert containing a case study for Section C in the centrefold
- Answer sheet for multiple-choice questions

Instructions

- Detach the insert from the centre of this book during reading time.
- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- All written responses must be in English.

At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.
- You may keep the detached insert.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

SECTION A – Multiple-choice questions**Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1; an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Question 1

The appropriate data types to represent a house number, street name, suburb and postcode are

- A. string, string, string, string.
- B. integer, string, string, string.
- C. string, string, string, integer.
- D. integer, string, string, integer.

Question 2

During the process of sorting an array of eight integers using the quick sort algorithm, the first partitioning of the array appears as shown below.

12	15	11	17	19	22	21	20
----	----	----	----	----	----	----	----

Which one of the following statements is correct?

- A. The pivot was either 17 or 19.
- B. Neither 17 nor 19 was the pivot.
- C. The pivot was 17; it was not 19.
- D. The pivot was not 17, but it could have been 19.

Use the following information to answer Questions 3 and 4.

Begin

```
Input score
If score > 75 Then
    If score >= 85 Then
        grade ← "A"
    Else
        grade ← "B"
    EndIf
Else
    grade ← "C"
EndIf
outputgrade
```

End

Question 3

The algorithm above needs to be tested for logic errors.

Which one of the following sets of test data would provide the best test for the algorithm?

- A. 0, 75, 80, 84, 100
- B. 70, 75, 76, 80
- C. 75, 76, 84, 85
- D. 0, 74, 84, 85

Question 4

The algorithm above contains

- A. classes and functions.
- B. methods and instructions.
- C. control structures and functions.
- D. selection statements and instructions.

Question 5

Locker requests	
First name	Surname
Full-time student	Student ID
Yes ☐ No ☐	

Which data structure would be the best option to store the data being collected from the form shown above?

- A. four one-dimensional arrays
- B. a single array
- C. a record
- D. a list

Question 6

When a student upgrades their operating system to a new version of the operating system, the updating software creates a new folder called 'OperatingSystem.old' and copies some of the computer's files to that folder.

This is an example of

- A. creating extra space for the computer's files.
- B. cleaning up the computer's files.
- C. backing up the computer's files.
- D. archiving the computer's files.

Question 7

An array is sorted in ascending order.

Starting point

13	6	64	25	12	22	11	17
----	---	----	----	----	----	----	----

After the **third** pass

6	11	12	25	64	22	13	17
---	----	----	----	----	----	----	----

Which type of algorithm is being used to sort the array?

- A. quick sort
- B. bubble sort
- C. binary search
- D. selection sort

Question 8

A software development business purchases software over the internet to assist with the encryption of files containing personal and financial details.

Copies of the software can be re-sold by the business provided that

- A. the software is open source.
- B. the software licence allows for this action.
- C. slight changes are made to the software before selling it.
- D. the business explicitly states that the software is copyright protected.

Use the following information to answer Questions 9 and 10.

Begin

Total $\leftarrow$ 0

For i = 0 to len(nums)

 If nums[i] $\geq$ 10 then

 Total $\leftarrow$ Total + nums[i]

EndIf

EndFor

 Display "the value of Total is" Total

End

Question 9

The purpose of the pseudocode above is to

- A. find the sum of all numbers in an array that are higher than 10.
- B. search for numbers in an array that are equal to or higher than 10.
- C. find the sum of all numbers in an array that are equal to or lower than 10.
- D. find the sum of all numbers in an array that are equal to or higher than 10.

Question 10

When converting the pseudocode above into a program, it would be useful to include the

- A. design specifications.
- B. constraints of the code.
- C. internal documentation.
- D. external documentation.

Question 11

A software developer is considering using a wired network to share large files with a client.

The advantages of a wired network compared to a wireless network are that it is

- A. faster and more secure.
- B. faster and more portable.
- C. more secure and portable.
- D. easier to set up and cheaper.

Question 12

Which type of security vulnerability manipulates users into providing confidential information through social engineering?

- A. phishing
- B. SQL injection
- C. cross-site scripting
- D. man-in-the-middle attack

Question 13

The purpose of the agile development model approach is to develop software solutions

- A. by focusing on the development stage only.
- B. through the continuous process of iteration, involving development and testing.
- C. by sequentially completing each stage of the problem-solving methodology, one stage at a time.
- D. by following an incremental and iterative approach over and over through each stage of the problem-solving methodology.

Question 14

XML stands for extensible mark-up language.

Which one of the following is true?

- A. An XML data file is designed to only display data on a web page.
- B. An XML data file will work as expected if some data is modified.
- C. An XML data file will never work as expected if some data is modified.
- D. An XML data file is interchangeable with an HTML file because they are both mark-up languages.

Question 15

Inta is writing a new application for a small bicycle company that will allow staff to use their mobile phones to access stock information stored on the company's files server. A manager and four other people sell the bicycles. They all use different brands of mobile phones.

To help with writing the software requirements specifications (SRS), Inta should

- A. interview all those who will use the new application.
- B. send out a survey to the manager and one other staff member.
- C. observe one of those who will use the new application at work.
- D. survey some of the people who have bought bicycles from the company.

Question 16

In accordance with which Act is the privacy of a Victorian's health information protected?

- A. *Privacy and Data Protection Act 2014*
- B. *Health Records Act 2001*
- C. *Copyright Act 1968*
- D. *Privacy Act 1988*

Question 17

Which one of the following correctly identifies features of type checking?

- A. checks if only letters are entered into a field and if the text is spelt correctly
- B. checks if data entered already exists in the database and if the data is reasonable
- C. checks if a number is entered into a numeric field and if the number is within a set range of values
- D. checks if numbers are entered into a numeric field and if letters are entered into a text-only field

Question 18

A data flow diagram can be used as a tool when designing software.

Data flow diagrams must always show the

- A. decisions that are made when sub-modules are called.
- B. sequence of tasks involved in completing a project.
- C. specific data flows between processes.
- D. specific data types and descriptions.

Question 19

Some of the variables in a program are to be given new names.

Which documentation must also be modified?

- A. functional requirements
- B. data dictionary definitions
- C. software requirements definitions
- D. milestones and dependencies

Question 20

A local shopping centre is considering providing free wi-fi for its customers.

Which one of the following would be a non-functional requirement for its new system?

- A. The system must have a failure rate of less than 3%.
- B. The system must be easy for customers to connect to.
- C. The system must be able to cope with 500 simultaneous users.
- D. The system must have a speed of at least 5 megabits per second.

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SECTION B – Short-answer questions**Instructions for Section B**

Answer **all** questions in the spaces provided.

Question 1 (3 marks)

A company stores the following data in a linear file for its payroll.

```
<company>
<name>Fireplace enterprises</name>
<staffid="1001">
    <staffname>Sue Jenkins</staffname>
    <salary>120000</salary>
</staffid>
<staffid="1002">
    <staffname>Mark Adimos</staffname>
    <salary>120000</salary>
</staffid>
</company>
```

Name three fields contained in this file.

1. _____
2. _____
3. _____

Question 2 (6 marks)

A government department has been issuing new employees with a sequential employee number for more than 70 years. Sequential employee numbers are now just under 100 000 and the department would like to know who has the smallest number and is still working for the department.

The employee records team has created a file containing the EmployeeName and the EmployeeNumber sorted on EmployeeName. They plan to write a simple program to search this file for the smallest number. They have started the pseudocode.

Fill in the missing lines in the pseudocode below to find the current employee with the smallest number and to print this employee's name and number.

Begin

LowestEmployeeName ← ""

LowestEmployeeNumber ← 100000

End

Question 3 (3 marks)

Explain the difference between an array and a record in relation to selecting an appropriate data structure for the development of a software solution.

Question 4 (3 marks)

The table below gives descriptions of different types of processing features.

Use the following list to complete the table with the correct processing feature for each description given.

class function method

Description	Processing feature
returns a value after performing an action	
defines the appearance and behaviour of an object	
instructions that perform an action associated with an object	

Question 5 (5 marks)

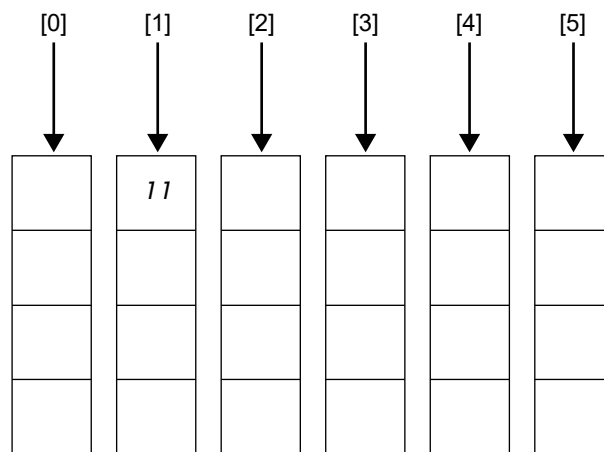
A hash function has been created to store a set of different integers in an array. The hash function creates a key value from the integer. The hash function takes the integer to be stored, divides the integer by 5 and uses the remainder as an index value. For example, if the first integer is 11, then 11 divided by 5 gives a remainder of 1. Hence, the hash key for the integer 11 is 1.

When a collision occurs because two integers hash to the same array location, the second integer is placed in the next available space under the hash key.

The numbers to be stored via the hash function are 11, 17, 23, 8, 13. The number 11 has already been entered.

- a. Complete the diagram below.

4 marks



- b. Outline how a value is retrieved using a hash key.

1 mark

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SECTION C – Case study**Instructions for Section C**

Please remove the insert from the centre of this book during reading time.

Use the case study provided in the insert to answer the questions in this section. Answers must apply to the case study.

Answer **all** questions in the spaces provided.

Patel and Janette select an organisation to develop the new Keep Fit application (app) for mobile devices, as well as the new communications software for the Soul & Body Health system that will enable the Keep Fit app to communicate with the existing software.

The selected organisation is called SofDevNow and it specialises in this type of software development.

SofDevNow assigns its most capable project manager, Sue-Lee, to work on this new project.

Question 1 (5 marks)

Sue-Lee begins to plan the project. She decides to use two programming teams.

To write, test and debug the Keep Fit app for the mobile devices will take about 25 days.

To write, test and debug the new Soul & Body Health communications software will take about 30 days.

The teams will then need to test that the Keep Fit app can communicate with the Soul & Body Health software. This should take about five days.

The next step would be to demonstrate the entire system to Janette and Patel, and to make modifications. This should take another five days.

SofDevNow would then need to install the new software on the server at the clinic and test it using the app, which would take another five days.

That gives Sue-Lee a total of 70 days.

- a. Complete the Gantt chart using the information provided.

4 marks

Task	Days													
	5	10	15	20	25	30	35	40	45	50	55	60	65	70
Write, test and debug the app for the mobile devices.														
Write, test and debug the Soul & Body Health software.														
Test that the app communicates with the Soul & Body Health software.														
Demonstrate the entire system to Janette and Patel, and make changes.														
Install the new software on the Soul & Body Health system.														

b. Name **one** milestone for the project.

1 mark

Question 2 (2 marks)

Sue-Lee begins to plan the software requirements specifications (SRS). She understands that she will need to follow the goals and objectives of Soul & Body Health.

Apart from financial considerations, state one organisational goal and one system objective.

Organisational goal _____

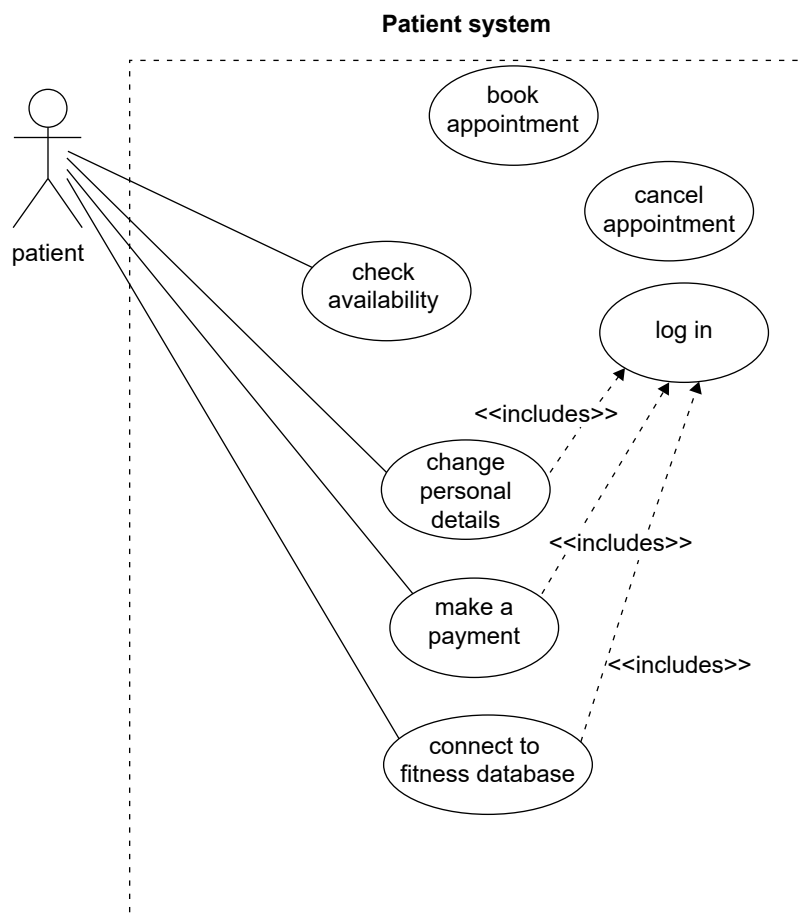
System objective _____

Question 3 (3 marks)

Sue-Lee now begins to prepare a use case diagram for the Keep Fit app. A patient should be able to log in and:

- check the availability of appointments
- make an appointment
- cancel an appointment
- pay any fees that are due
- change personal data
- download their own Keep Fit data.

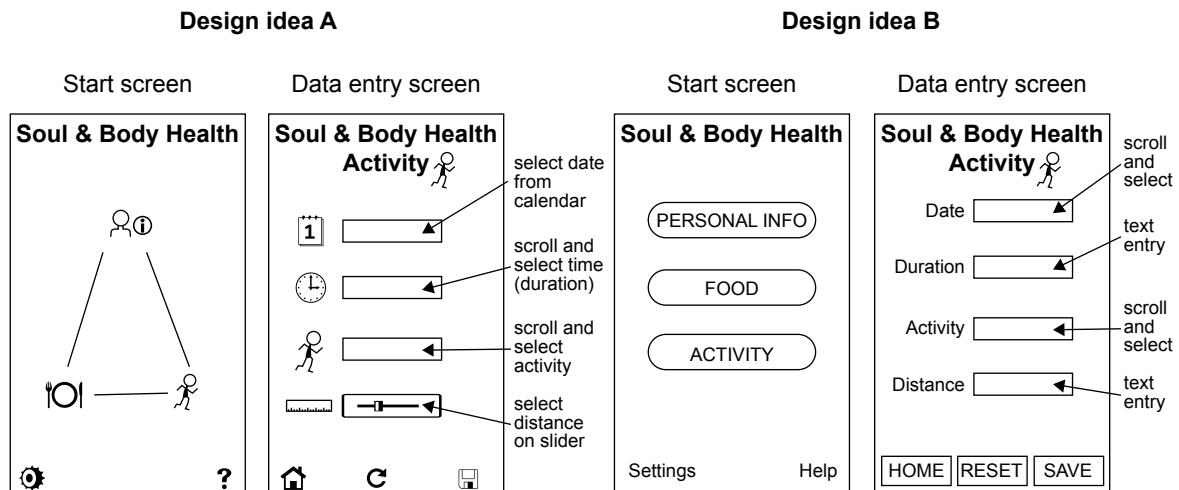
Complete the use case diagram below by indicating all of the requirements.



Question 4 (4 marks)

Patel and Janette have asked SofDevNow to take a simple approach to the design of the Keep Fit app. They want error-handling features, simple navigation between the components of the solution, and a clean and clear interface that allows for easy data entry regardless of the mobile device. They also want it to be interesting to look at.

Sue-Lee has developed two design ideas for the app. Each design idea includes a start screen and one of the data entry screens. The design ideas are shown below.



- a. Describe one feature of each design idea that contributes to its effectiveness. 2 marks

Feature of Design idea A _____

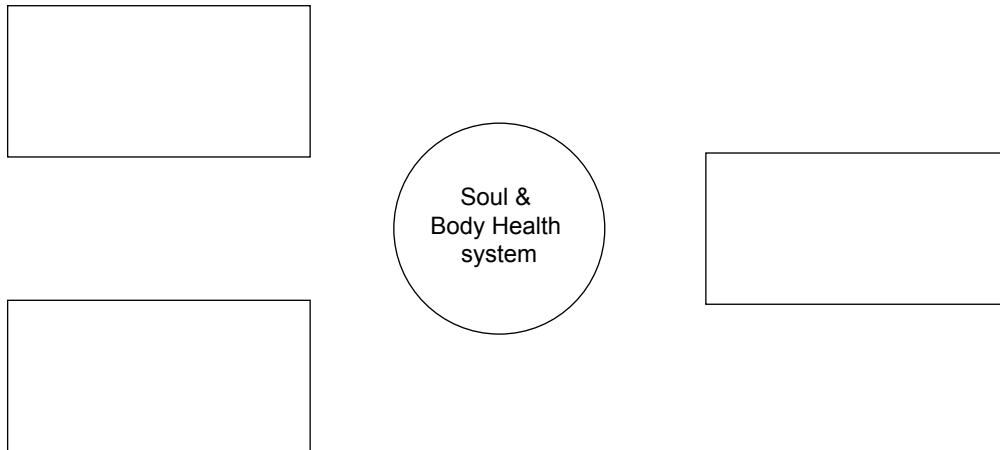
Feature of Design idea B _____

- b. Which design idea would you choose, based on the stated requirements? Justify your answer. 2 marks

Question 5 (3 marks)

Sue-Lee looks at the flow of data to and from the Keep Fit app and the Soul & Body Health system by starting to draw a context diagram.

Continue the context diagram below by naming the three entities and showing **one** data flow from each entity.



Question 6 (3 marks)

Before Sue-Lee can organise the writing, testing and debugging of the Keep Fit app and the Soul & Body Health communications software, she needs to consider which development model approach should be followed. She is aware of the agile, spiral and waterfall models.

Based on her project plan, Sue-Lee has selected the waterfall development model for developing the app and the communications software.

Justify the use of the waterfall development model by Sue-Lee.

Question 7 (9 marks)

Sue-Lee tells Patel and Janette that the patient system at the Soul & Body Health head office will need to store sensitive information. This will influence the design of the Keep Fit app and the Soul & Body Health communications software.

- a. Identify **one** appropriate security consideration that could be used to protect this data and explain how it would work.

3 marks

- b. Describe **one** backup procedure that could be used to back up this data. Refer to the technique used and the frequency of the backup procedure.

3 marks

- c. It has been suggested that patients who have not visited Soul & Body Health for more than five years should have their records archived.

Explain what is meant by ‘archiving’ and provide **one** advantage of archiving records.

3 marks

Question 8 (6 marks)

The new software for Soul & Body Health's system will be receiving sensitive information from the new Keep Fit app from all the patients. Sue-Lee is investigating how the patients' mobile devices could send this information as securely as possible. She is aware that there are potential software security and data security vulnerabilities when developing the software at SofDevNow.

- a. Apart from the patient's name, list **three** pieces of sensitive information that the new software will need to keep secure.

3 marks

- b. Identify a potential vulnerability to software and data security at SofDevNow, and recommend one risk management strategy to minimise this vulnerability when using the software.

3 marks

Vulnerability _____

Risk management strategy _____

Question 9 (5 marks)

Sue-Lee's identification of the potential security vulnerabilities has highlighted the importance of appropriate physical and software security controls at SofDevNow.

- a.** What is the difference between a physical security control and a software security control? 2 marks

- b.** Briefly describe why each of the following is an important security control. 3 marks

- Version control _____

- User authentication _____

- Software updates _____

Question 10 (3 marks)

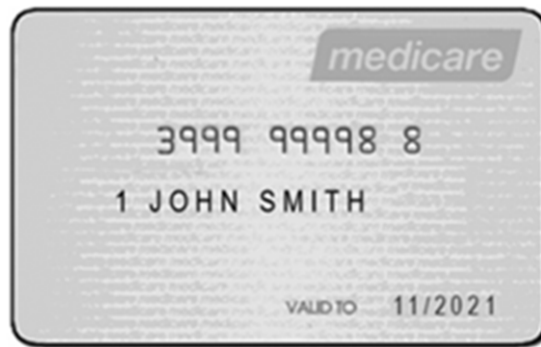
Patel has questions about the use of patient information. He is concerned about who owns the patient information stored on Soul & Body Health's system and what his and Janette's legal obligations are concerning this information.

Outline three actions that Patel and Janette should take to ensure that they meet Soul & Body Health's legal obligations before purchasing the software from SofDevNow.

1. _____

2. _____

3. _____

Question 11 (4 marks)

Soul & Body Health's new software will be able to connect to the national healthcare system so that patient healthcare numbers can be verified. A patient healthcare number contains 10 digits, as shown on the card above.

Sue-Lee would like to be able to check that the data that will be used by Soul & Body Health's new software has integrity.

List two characteristics of data that has integrity and explain one method Sue-Lee could use to check the integrity of the data.

Characteristic 1 _____

Characteristic 2 _____

Explanation _____

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Question 12 (8 marks)

The Keep Fit app can be used to record all exercise that a patient does and calculate the energy used. A patient selects from different exercise styles and then answers questions such as distance travelled and how much time the exercise took.

One exercise that can be selected is running. The app takes into account the patient's weight and any other special factors in a disability index set by the physiotherapist.

The patient's average speed can be calculated by dividing the distance covered by the time taken. The algorithm to do this is complicated and will work properly only for speeds greater than 1 km/h and less than 30 km/h. This is considered a satisfactory range.

- a. It is necessary to make sure that the speed is within these limits.

What is this input testing called?

1 mark

- b. Sue-Lee has written the following pseudocode to check that the speed meets the range.

```

Begin ValidSpeed ← False
    If Speed >= 1 And Speed <= 30 Then
        ValidSpeed ← True
    EndIf
End

```

Complete the following test data table to fully test this pseudocode.

4 marks

Test number	Test data	Expected results	Actual results
1	20	ValidSpeed = True	ValidSpeed = True
2			
3			
4			
5			

- c. What is the invalid response produced by the pseudocode given in **part b.**?

1 mark

d. Rewrite the pseudocode given in **part b.** so that it works correctly.

2 marks

Question 13 (5 marks)

When the Keep Fit app and the communications software is in place with Soul & Body Health, the government will require a summary of who has been treated under its health plans and what treatment they have received.

Sue-Lee was considering sending this data in a plain text file organised on the basis of when the data was created. Now she has found out that the government's data upload tool supports only XML files.

- a. In terms of the structure of the file, what advantages does an XML file have over a plain text file?

2 marks

- b. The government requires that all files transmitted to the national healthcare system are encrypted. Sue-Lee is aware that the files must be encrypted but is concerned that adding this feature will add to the cost of the app and communications software development for Soul & Body Health. She did not discuss this with Patel and Janette when determining requirements. Sue-Lee is concerned about the ethical consequences for her organisation if she does not discuss this with Patel and Janette.

Discuss **two** ethical consequences for Sue-Lee and SofDevNow, and state the course of action that Sue-Lee should recommend.

3 marks

Consequence 1 _____

Consequence 2 _____

Recommendation _____

Insert for Section C – Case study

Please remove from the centre of this book during reading time.

Soul and Body Health

Patel and Janette have started a small, suburban physiotherapy clinic. They both have a professional interest in a holistic approach¹ to health and wellbeing. They have called their business Soul & Body Health.

Business is steady, so Patel and Janette decide to expand the number of clinics. They establish three more clinics around the state.

Patel and Janette's original clinic has become their head office. It contains their files server and the commercial medical software required to keep both medical and financial patient records. The software allows them to connect to the national healthcare system so that rebates² can be claimed from the government. It also allows Soul & Body Health to upload other data files to the healthcare system.

Improving patient care

Patel and Janette feel that they can improve patient care by introducing preventive healthcare. They have decided to provide extra services to their patients through a new fitness application (app). The app they want to develop will be called Keep Fit.

The purpose of the app will be to:

- allow patients to make appointments and pay invoices issued by the head office online
- provide an online recording service to help patients record their daily dietary intake as well as their daily exercise.

Communications software will also be required to enable the Keep Fit app to communicate with the existing commercial patient software.

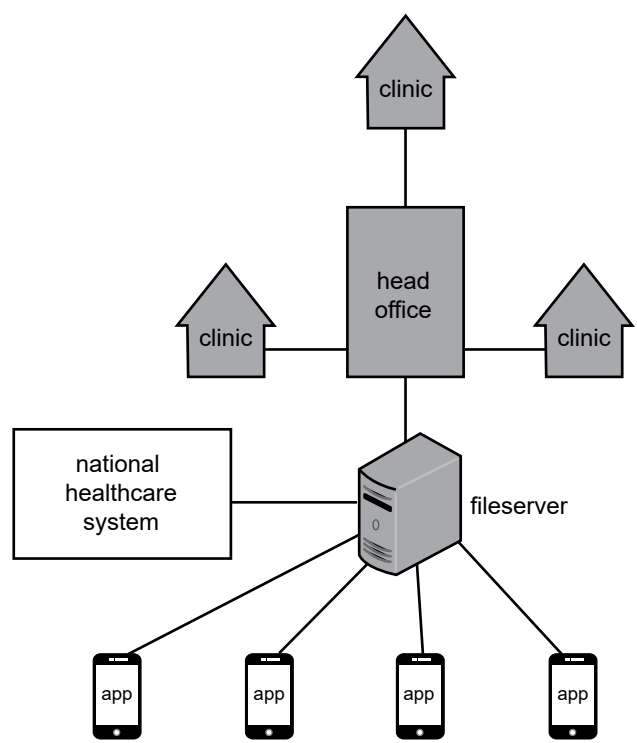
Patel and Janette believe that patients will benefit from detailed knowledge of their eating and exercising habits. The data will be held locally, on each patient's mobile device, and then uploaded to the Soul & Body Health server each night or when it is convenient.

Patel and Janette feel that, in addition to having detailed knowledge of their eating and exercising habits, patients will benefit from a more holistic approach to their health and maintain an accurate record of their diet and exercise plan.

¹**holistic approach** – an approach concerned with the whole person (physical, mental and emotional)

²**rebate** – return of part of an amount paid or due for a service

Overview of Soul & Body Health’s Keep Fit app



Answers to multiple-choice questions

Question	Answer
1	A
2	A
3	C
4	D
5	C
6	C
7	D
8	B
9	D
10	C
11	A
12	A
13	D
14	B
15	A
16	B
17	D
18	C
19	B
20	B